

Customer No.: 31561  
Application No.: 10/707,683  
Docket No.: 11846-US-PA

### **REMARKS**

#### **Present Status of the Application**

The Office Action rejected claims 1, 3-6, 8 under 35 U.S.C. 103(a) as being unpatentable over Combs (US 6,734,552) in view of Eguchi (US 6,627,997). The Office Action rejected claim 7 under 35 U.S.C. 103(a) as being unpatentable over Combs in view of Eguchi and further in view of Call (US 5,471,027). The Office Action rejected claim 8 under 35 U.S.C. 103(a) as being unpatentable over Combs in view of Eguchi and further in view of Huang (US 6,844,622). The Office Action rejected claims 9, 11-18 and 20 under 35 U.S.C. 103(a) as being unpatentable over Combs in view of Eguchi and further in view of Yang (US 2003/0141582). The Office Action rejected claims 9, 11-16, 18, 20 under 35 U.S.C. 103(a) or 35 U.S.C. 103 (a) as being unpatentable over Pu (US 6,610,560). The Office Action rejected claim 17 under 35 U.S.C. 103(a) as being unpatentable over Pu in view of Eguchi and further in view of Combs. The Office Action rejected claim 19 under 35 U.S.C. 103(a) as being unpatentable over Pu in view of Eguchi and further in view of Call. The Office Action rejected claim 20 under 35 U.S.C. 103(a) as being unpatentable over Pu in view of Eguchi and further in view of Huang.

Applicants have amended claims 1, 9 and cancelled claims 3, 11 to more clearly define the present invention. After entry of the foregoing amendments, claims 1, 4-9, 12-20 remain pending in the present application, and reconsideration of those claims is respectfully requested.

#### **Discussion of Office Action Rejections**

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*Applicants respectfully traverse the rejection of claims 1, 4-6, 8 under 103(a) as being unpatentable over Combs (US 6,734,552) in view of Eguchi (U.S.6,627,997) because a prima facie case of obviousness has not been established by the Office Action.*

To establish a prima facie case of obviousness under 35 U.S.C. 103(a), each of three requirements must be met. First, the reference or references, taken alone or combined, must teach or suggest each and every element in the claims. Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the references in a manner resulting in the claimed invention. Third, a reasonable expectation of success must exist. Moreover, each of the three requirements must "be found in the prior art, and not be based on applicant's disclosure." See M.P.E.P. 2143, 8<sup>th</sup> ed., February 2003.

The present invention is in general related to a chip package structure as claim 1 recites:

Claim 1. A chip package structure, comprising:  
a carrier;  
a chip, having an active surface with a plurality of bumps thereon, wherein the chip is flipped over and bonded to the carrier in a flip-chip bonding process so that the chip and the carrier are electrically connected;  
a heat sink, set over the chip, wherein the chip is separated from the heat sink by a distance between 0.03 ~ 0.2mm; and  
an encapsulating material layer, filling a bonding gap between the chip and the carrier as well as a gap between the heat sink and the chip, wherein the encapsulating material layer is formed in a simultaneous molding process and part of the surface of the heat sink away from the chip is exposed, *wherein the encapsulating material layer has a thermal conductivity greater than 1.2W/m.K.*

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Combs and Eguchi fail to teach or suggest that the encapsulating material layer has a thermal conductivity greater than 1.2W/m.K. The Office Action points out it would have been obvious to have selected and optimized the thermal conductivity of the encapsulating material layer. However, Combs just discloses the encapsulant 140 may be an epoxy based material. As a matter of fact, the thermal conductivity of the epoxy based material is lower than 1.2W/m.K. Applicants provide a reference showing three encapsulating materials that are usually used in chip packages and their thermal conductivities. In particular, CV8500C is an epoxy based material, and its thermal conductivity is 0.96 W/m.K (lower than 1.2W/m.K). Therefore, the encapsulating materials generally used in chip packages have a thermal conductivity lower than 1.2W/m.K.

	CV5788TN	CV5310AT	CV8500C (epoxy molding compound)
Thermal conductivity	0.88 W/m.K	0.71 W/m.K	0.96 W/m.K

However, in claim 1 of the present application, the chip package structure comprises an encapsulating material layer having a thermal conductivity greater than 1.2W/m.K and a heat sink separating from the chip by a distance between 0.03 ~ 0.2mm. Thus, the chip package structure has superior heat dissipating capacity than conventional chip packages. In conventional

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chip packages, because the distance between the chip and the heat sink is greater and the thermal conductivity of the encapsulating material is poor, the chip package has heat dissipation problem when a high power chip is incorporated.

Since Combs and Eguchi fail to teach or suggest that the encapsulating material layer has a thermal conductivity greater than 1.2W/m.K, the two references combined do not teach or suggest each and every element in claim 1. Applicant respectfully submits that independent claim 1 patently defines over the prior art reference, and should be allowed. For at least the same reasons, dependent claims 4-6, 8 patently define over the prior art as well.

*Applicants respectfully traverse the rejection of claim 7 under 35 U.S.C. 103(a) as being unpatentable over Combs in view of Eguchi and further in view of Call (US 5,471,027) and the rejection of claim 8 under 35 U.S.C. 103(a) as being unpatentable over Combs in view of Eguchi and further in view of Huang (US 6,844,622) because a prima facie case of obviousness has not been established by the Office Action.*

Applicants submit that, as disclosed above, Combs and Eguchi fail to teach or suggest each and every element of claim 1, from which claims 7-8 depend. Call and Huang also fail to teach or suggest that the encapsulating material layer has a thermal conductivity greater than 1.2W/m.K. Therefore, Call and Huang cannot cure the deficiencies of Combs and Eguchi. Independent claim 1 is patentable over Combs, Eguchi, Call and Huang. For at the least the same reasons, its dependent claims 7-8 are also be patentable.

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*Applicants respectfully traverse the rejection of claims 9, 12-18 and 20 under 103(a) as obvious over Combs taken with Eguchi and Yang (US 2003/0141582) because a prima facie case of obviousness has not been established by the Office Action.*

The present invention is in general related to a chip package structure as claim 9 recites:

Claim 9. A chip package structure, comprising:

a carrier;

a chipset, set over and electrically connected to the carrier, wherein the chipset comprises a plurality of chips, at least one of the chips is bonded to the carrier or another chip in a flip-chip bonding process so that a flip-chip bonding gap is created;

a heat sink, set over the chipset, wherein the chipset is separated from the heat sink by a distance between 0.03 ~ 0.2mm; and

an encapsulating material layer, filling the flip-chip bonding gap and a gap between the chipset and the heat sink, wherein the encapsulating material layer is formed in a simultaneous molding process and part of the surface of the heat sink away from the chipset is exposed, *wherein the encapsulating material layer has a thermal conductivity greater than 1.2W/m.K.*

As discussed above, Combs and Eguchi fail to teach or suggest that the encapsulating material layer has a thermal conductivity greater than 1.2W/m.K. Yang also fails to teach or suggest that the encapsulating material layer has a thermal conductivity greater than 1.2W/m.K. In Yang's reference, two or three chips are stacked on a substrate, and a package material 180 encloses the chips and wires on the substrate. However, Yang does not disclose the package material 180 has a thermal conductivity greater than 1.2W/m.K. Yang cannot cure the deficiencies of Combs and Eguchi. Therefore, independent claim 9 is patentable over Combs, Eguchi and Yang. For at the least the same reasons, its dependent claims 12-18, 20 are also be patentable.

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*Applicants respectfully traverse the rejection of claims 9, 12-16, 18 and 20 under 35 U.S.C. 103(a) as being unpatentable over Pu (US. 6,610,560) in view of Eguchi because a prima facie case of obviousness has not been established by the Office Action.*

As discussed above, Eguchi fails to teach or suggest that the encapsulating material layer has a thermal conductivity greater than 1.2W/m.K. Pu also fails to teach or suggest that the encapsulating material layer has a thermal conductivity greater than 1.2W/m.K. In Pu's reference, the package structure, as shown in Fig. 2D, includes three chips 210, 220, 230 and a heat sink 290, wherein the surfaces 220b, 230b of the chips 220, 230 are exposed to the outside of the encapsulation body 270. Pu just discloses the encapsulation body 270 is formed to encapsulate all the semiconductor chips 210, 220, 230 over the circuited substrate 200. Pu does not teach or suggest that the encapsulation body 270 has a thermal conductivity greater than 1.2W/m.K. Therefore, the two references (Pu and Eguchi) combined do not teach or suggest each and every element in the claim 9. Applicant respectfully submits that independent claim 9 patently defines over the prior art references, and should be allowed. For at least the same reasons, dependent claims 12-16, 18 and 20 patently define over the prior art as well.

*Applicants respectfully traverse the rejection of claim 17 under 35 U.S.C. 103(a) as being unpatentable over Pu in view of Eguchi and further in view of Combs, the rejection of claim 19 under 35 U.S.C. 103(a) as being unpatentable over Pu in view of Eguchi and further in view of*

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*Call and the rejection of claim 20 under 35 U.S.C. 103(a) as being unpatentable over Pu in view of Eguchi and further in view of Huang because a prima facie case of obviousness has not been established by the Office Action.*

Applicants submit that, as disclosed above, Pu and Eguchi fail to teach or suggest each and every element of claim 9, from which claims 17, 19-20 depend. Call and Huang also fail to teach or suggest that the package material 180 has a thermal conductivity greater than 1.2W/m.K. Therefore, Call and Huang cannot cure the deficiencies of Pu and Eguchi. Independent claim 9 is patentable over Pu, Eguchi, Call and Huang. For at the least the same reasons, its dependent claims 17, 19-20 are also be patentable.

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**CONCLUSION**

For at least the foregoing reasons, it is believed that the pending claims are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

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Respectfully submitted,

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